Program III. **EQUATIONS AND INEQUALITIES**:

SOL Topic:

A.1

The student will solve linear equations and inequalities in one variable, solve literal equations (formulas) for a given variable and apply these skills to solve practical problems. Graphing calculators will be used to confirm algebraic solutions.

Activity 1: **Solving linear inequalities in one variable.**

Solve: $2x - 7 < 0$ in Zoom-4 window (Decimal Window) and identify the x-values for which $y < 0$.

- Graph: $Y_1 = 2x - 7$
- "2nd TRACE" ("2nd CALC") find the zero.
- The solution is $x < 3.5$

Show Boolean Representation:

- Graph: $Y_2 = 2x - 7 < 0$
- Observe the horizontal line through $y = 1$, representing where the statement is true.

Activity 2: **Solve literal equations (formulas) for a given variable and apply these skills to solve practical problems.**

Margaret is traveling from Norfolk, VA to Williamsburg, VA. She knows that the store opens at 9am, and she wants to know what time she has to leave home in order to make the sale at the Outlet Mall. The distance from Norfolk to the Outlet Mall is 50 miles. If she travels at an average rate of 47.5 mph, what is the elapsed time for travel and what time does she have to leave home?

Using the MATH menu, "Solver...", go to equation solver and enter the formula for TIME-RATE-DISTANCE problems.

- equ: $0 = T * R - D$

- T = ?
- R = 47.5
- D = 50

Press “ALPHA”, “ENTER” when the cursor is placed on the “T =”
T = 1.0526315789474 hours for elapsed time
Go to home screen:

- “Clear”, “Alpha” , "T", “ENTER”
- Subtract 1 , “ENTER”
- Multiply by 60, “ENTER”
- Subtract 3, “ENTER”
- Multiply by 60, “ENTER”

The result is 1: 03: 09 for the elapsed time.

Subtract this answer from 9am to find departure time.

- 85960 (represents 9 am)
- subtract 10309 , “ENTER”

The result is 75651.

Margaret needs to leave at 7: 56 : 51 am. For our purpose 8am is good enough.
(Note: Use twenty-four hour clock for extensions)

SOL Topic:

A.6

The student will select, justify, and apply an appropriate technique to graph a linear function in two variables. Techniques will include slope-intercept, x- and y-intercepts, graphing by transformation, and the use of the graphing calculator.

Activity 3: **Graphing a a linear function in two variables using the slope-intercept format. For the formula y = mx + b.**

Examples of linear transformations may be shown by:
Same m, different b:

- $Y_1 = x + 3$
- $Y_2 = x + 1$
- $Y_3 = x - 2$

Same b, different m:

- $Y_1 = 2x + 3$
- $Y_2 = -3x + 3$
- $Y_3 = 0.5x + 3$

Using lists in "Y =":

- Y1 = x + {3, 1, 2}
- Y2 = {2, -3, 0.5} x + 3

SOL Topic:

AII.4

The student will solve absolute value equations and inequalities graphically and algebraically. Graphing calculators will be used both as a primary method of solution and to verify algebraic solutions.

Activity 5: **Solve absolute value equations and inequalities**

Solve: $|x| = 3$ in a Zoom-4 (Decimal window), find two points of intersection

- $Y_1 = \text{abs}(x)$
- $Y_2 = 3$

Solve: $|x| < 3$

- $Y_1 = \text{abs}(x)$
- $Y_2 = 3$
- $Y_3 = Y_1 - Y_2$
- $Y_4 = Y_1 < Y_2$

Solve: $|x + 2| < |x|$

- $Y_1 = |x + 2|$
- $Y_2 = |x|$
- $Y_3 = Y_1 - Y_2$
- $Y_4 = Y_1 < Y_2$

SOL Topic:

AII.7

The student will solve equations containing rational expressions and equations containing radical expressions algebraically and graphically. Graphing calculators will be used for solving and confirming algebraic solutions.

Activity 6: **Graph rational expressions and solve rational equation problem. Introduce a mixture problem.**

Graph:

- $Y_1 = ((x + 3)(x - 3)) / (x + 4)$ observe asymptotic behavior for x = -4
- $Y2 = ((x + 3)(x - 3)) / (x - 3)$ show a "hole" in the graph at x = 3

A "Mixture" Problem:

Ozzie likes the red M&M candies and would like for every 1 out of 4 to be red. As a birthday treat for Ozzie, we are going to mix 5 pounds of regular M&M's (8% red) with some holiday M&M's (48% red) in order to have a mixture where the concentration of red candies is 25%. How many pounds of the holiday M&M's must we add to the regular candy?

$$\mathbf{C(x)= \frac{\text{amount of red candies}}{\text{total amount of r ed candies}}}$$

concentration is a function of x (the amount added)

Pounds of Holiday M & M 's added	Ratio of Pounds of Red Candies to Total Pounds	% Red Candies
1	$\frac{0.48(1) + 0.08(5)}{1 + 5} = 0.147$	14.7%
2	$\frac{0.48(2) + 0.08(5)}{2 + 5} = 0.194$	19.4%

AII.6

The student will select, justify, and apply a technique to solve a quadratic equation over the set of complex numbers. Graphing calculators will be used for solving and confirming algebraic solutions.

Activity 7: **Solve quadratic equations over the set of complex numbers in a graphing environment.**

Graph individually in a Zoom-4 window and observe where the graph crosses the x-axis.

- $Y_1 = x^2$ tangent to the x-axis
- $Y_2 = x^2 - 1$ crosses the x-axis twice
- $Y_3 = x^2 + 1$ does not cross the x-axis
- $Y_4 = x^2 + x + 1$ does not cross the x-axis

Look at the table values where $Y_1 = 0$, $Y_2 = 0$, $Y_3 = 0$, and $Y_4 = 0$ to find the roots.

- Use TRACE on the graph screen, type an x-value to find where Y = 0.
- Use the 2nd CALC menu to find the zeros, show how the roots cannot be found when the roots are complex.
- Discuss the meaning of "estimate, approximate, guess"
- Use the board to show the quadratic formula method for finding complex roots for "$x^2 + x + 1 = 0$"

Show the Rectangular Complex Mode, Change MODE to "a + bi".

- Add complex numbers (3 + 6i) + (4 - 8i)
- Subtract complex numbers
- Multiply complex numbers
- Divide complex numbers

Show the iterating powers of "i" on the home screen:

- 1 ENTER
- press * i , ENTER
- ENTER
- ENTER...